OXALIS LABURNIFOLIA JACQ. AND ITS STATUS AS A SPECIES, WITH A DESCRIPTION OF A NEW VARIETY AND (II) NOTES ON THE AERIAL BULBILS IN OXALIS LABURNIFOLIA JACQ.

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Oxalis laburnifolia Jacq. was described and figured (No. 42, tab. 28) in Jacquin's Oxalis Monographia (1794) from a long-styled plant grown in Vienna, from bulbs probably obtained by the collectors Boos and Scholl in 1786. Another form of it is also figured (No. 42, tab. 29) under the name *O. sanguinea* Jacq., the latter plant only differing in being medio-styled. Jacquin did not realise that the flowers of Oxalis were trimorphic, and the two are undoubtedly conspecific.* Until recent years the only other collecting of this species was that of Zeyher, about 120 years ago (No. 225, from between Olifant's River and Knackisberg).

In 1935 it was re-discovered by Dr. P. Le F. Nortier of Clanwilliam, who kindly directed me to the site on the Ouplaas Hills, about 3 miles north-west of Klaver in the Van Rhyn's Dorp Division, where a set of specimens, *Salter* 5445, identical with Zeyher's specimens, was collected and bulbs were planted at Kirstenbosch.

In *Zeyher* 225 the oblong leaflets† were narrower than those figured by Jacquin and it was treated by Sonder as a variety (var. *angustata* Sond.), but, as in the case of some other species of Oxalis, the leaflets sometimes tend to become wider in cultivation. Bulbs grown from *Salter* 5445 produced leaves very similar to those in Jacquin's figure and Sonder's variety cannot, therefore, be upheld. Turczaninow did not recognise Zeyher's specimens as *O. laburnifolia* and gave them the name *O. arthrophylla* Turcz., now a synonym.

There are, however, two other forms of this species, one with the typical rotund leaflets of *O. purpurea* L., the other somewhat variable but always with longer leaflets and intermediate with the typical *O. laburnifolia*. All three, however, are practically identical in all other respects, having the characteristic corolla tube and pellucidly-streaked leaflets of *O. purpurea* L., though the latter character is not very obvious until the plant is dried and the streaks turn black. In all three forms the juvenile leaves are rotund.

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* In both Figures only bulbils are shown. The mature bulb is ovoid or oblong-ovoid, hard, dark brown, somewhat sticky, up to 6 cm. long.

† Outlines of the leaves in the different Forms of *O. laburnifolia* are shown in Fig. 1.

In my revision of the South African Oxalis,* after some consideration, I placed all three forms as Forms E (i), E (ii) and E (iii) of *O. purpurea* L., principally because the common and more widely distributed form with rotund leaflets and with both primrose-yellow and white flowers, is not easy to distinguish from several of the other Forms of *O. purpurea* L. either in the flowering stage or after drying. Although I was aware that in cultivation both the rotund Form E (i) and the intermediate Form E (ii) produce masses of small aerial bulbils in the axils of the leaves, a character not observed in any of the other Forms of *O. purpurea*, the only surviving plant of Form E (iii), the typical *O. laburnifolia* (*Salter* 5445) *did not produce them.* The plant was sickly and on its last legs, which may account for its failure to do so.

Last year Dr. Nortier was good enough to collect for me a fresh set of bulbs of the typical *O. laburnifolia* from 24 miles north of Lambert's Bay, i.e. in the region of the previous collectings. This year these plants (Nat. Bot. Gar. 263/46) have also produced similar aerial bulbils.

All three Forms have the following characters in common, distinguishing them from *O. purpurea* L.—a red, somewhat flattened petiole with a perceptible channel along the upper side, a reddening, often intense, on the under face of the leaflets or more rarely confined to the veins, and the very important characters of the aerial bulbils and the action of the contractile root in the second year, as explained in Part II. I am, therefore, now of opinion that *O. laburnifolia* and its group should retain specific rank.

No evidence of hybridisation between the three Forms has been observed, and in the only case where two of them, E (i) and E (iii), were found in association, there were no intermediate plants.† The intermediate plant is rather local and each colony observed has been of one pure strain. Since the transition between the two forms with broader leaflets may not be absolutely definite, one variety *latifolia*, with Forms A and B, is proposed.

Oxalis laburnifolia Jacq. var. latifolia Salter, var. nov. (*O. purpurea* L., Forms E (i) and E (ii) Salter). *Foliola* quam typica latiora, infra saturate rubra, lineis parvis obscure pellucidis (quum siccis atris) punctata, raro brunneo-maculata : medianum rotundatum basin versus plus minusve attenuatum, quam latum parum longius ad duplo longius: lateralia minora, rotundata vel obovato-oblonga vel fere semiorbicularia. *Corolla* lacteo-lutea vel alba tubo luteo.

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* The Genus Oxalis in South Africa, a Taxonomic Revision (Salter), Kirstenbosch, 1944, p. 140.

† The set *Zeyher* 225 in the South African Museum consists of 9 specimens of the form with narrow leaflets and one with leaflets of the intermediate form (Form E (ii)). Owing to the mistakes in distribution or mounting of Zeyher's specimens, it is impossible to say whether this was collected at the same time as the others.

Leaflets broader than in the *type*, deep red beneath, dotted with short inconspicuous pellucid streaks, rarely brown-mottled, the medial rotund, more or less attenuate at the base, from little longer to twice as long as broad, the lateral smaller, rotund, obovate-rotund or almost semicircular. Corolla primrose yellow, or white with a yellow tube.

Form **A.** (*O. purpurea* L., Form E (i) Salter). Medial leaflet little longer than broad. Corolla primrose yellow or white.

Yellow: Clanwilliam Div.; *Salter* 676, 724, 728, 744, 2149, 2448, 2600, 3423, 8126; 12 miles north of Clanwilliam, *Salter* 5613 (*type* ex. Herb. Salter* at Kirstenbosch): Picketberg Div.; *Salter* 664, 5653, *Pillans* 6631. *White*: Clanwilliam Div.; *Salter* 677, 6632.

There may be other specimens in Herbaria. It would probably be impossible to distinguish them from some of the other Forms of *O. purpurea* L., since they are now colourless and the aerial bulbils do not develop in the flowering stage. Moreover, the majority of the specimens cited above have not been definitely seen producing aerial bulbils.

Form **B.** (*O. purpurea* L., Form E (ii) Salter). Leaflets usually larger, the medial once and a half to twice as long as broad. Corolla primrose yellow.

Clanwilliam Div.; 5½ miles west of Graafwater, *Salter* 7245 (*type* ex. Herb. Salter at Kirstenbosch), and separate colonies in the vicinity, 7243, 7247.

Note:—In the typical form of *O. laburnifolia* the medial leaflet is 3—5 times as long as broad and the leaflets most commonly only red on the medial vein beneath. In all three forms the corollas and leaves soon become colourless after drying.

These notes illustrate to some extent the exceptional difficulties which confront the systematist in classifying the species in this genus without the fullest data from living plants and the impossibility of working from herbarium specimens alone.

II. NOTES ON THE AERIAL BULBILS OF OXALIS LABURNIFOLIA JACQ.

The life-cycle of the aerial bulbils produced in the axils of the leaves of Oxalis is at present very imperfectly known. Several species† produce them, mostly those of the acaulescent type. How far, if at all, their development is subject to the age of the plant or possibly, in some species, influenced by lack of fertilisation of the flowers, is an elaborate problem.

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* My personal collection of South African Oxalis has now been incorporated in the Herbarium at the National Botanic Gardens at Kirstenbosch.

† See "The Genus Oxalis in South Africa," p. 35.

These notes are confined to observation of the aerial bulbils in *O. laburnifolia* Jacq., var. *latifolia* Salter, Form B, growing in the National Botanic Gardens at Kirstenbosch (*Salter* 7243). In all forms of this species robust plants, at least, produce such bulbils in cultivation.

Unlike the species *O. Fergusoniae* Salter, where the aerial bulbils are well developed at flowering time, here they do not appear until the flowers are well over, i.e. in August. They form a hedgehog-like mass at the crown of the rhizome and they seem to mature rapidly and soon break away at a touch. Several hundreds of such bulbils may be produced by a healthy plant and in their natural habitat, in this case a region where baking sun and high winds are the rule, owing to their chaff-like nature, their mortality must be enormous, since, on falling from the parent plant, they are inactive until the following April or May. Though they are *capable* of developing into new plants while lying on the surface of the soil, it is probably that, as a rule, only those survive that are blown into crevices or washed into the soil by rain.

A number of these bulbils, after gathering in September, were placed on the surface of the soil in a glass dish and moistened from time to time. Eventually, in April, they began to send down a slender pale root from the base. Unfortunately mould set in and the experiment went no farther, but one of these bulbils, with a basal root about 6 mm. long, was dried in a capsule and was found later to have produced colourless stem and leaf growth, a characteristic of all Oxalis bulbs in the herbarium if they are not thoroughly soaked with poison.

Mr. F. W. Thorns, late curator at Kirstenbosch, had, at my request, " sowed " some of these bulbils in a tin in the open, half on the surface and half just covered with soil. Growth was more marked in the case of those covered, but it is not known how far those placed on the surface may have suffered from outside interference, such as birds, slugs, etc.

The next stage of observation was that of the minute plants growing from aerial bulbils around the parent plants in the nursery beds at Kirstenbosch. These were taken out late in August. They were found in the state shown in diagramatic form in Fig. 1. A new bulb, 1—2 cm. long (*b*) is produced at a depth of 3—6 cm. on a short stalk (*s*) emerging from the base of a very slender (about 0·1 mm. in diam.) intercalary elongation (*e*) of the rhizome or short underground stem (*r*), the original aerial bulbil being exhausted, with its tunics (*t*) persisting loosely in their original position around the base of the rhizome where it commences its elongation downwards. Immediately below the new bulb (*b*) is a root, contractile and shrivelled in its upper part, 0·5—1 mm. in diam. (*cr*), but slender and non-contractile below (*n*). The nature of this contractile root in its earlier stages still requires investigating.

Two-year-old plants examined in September and October show that the contractile action in the second year appears to be exactly similar. Here a new bulb, on a lateral stalk above the small shrivelled contractile root, was found to have been drawn down to a depth of 11 ·5 cm., probably the final depth required, but such bulbs have not attained the size of those in fully grown plants.

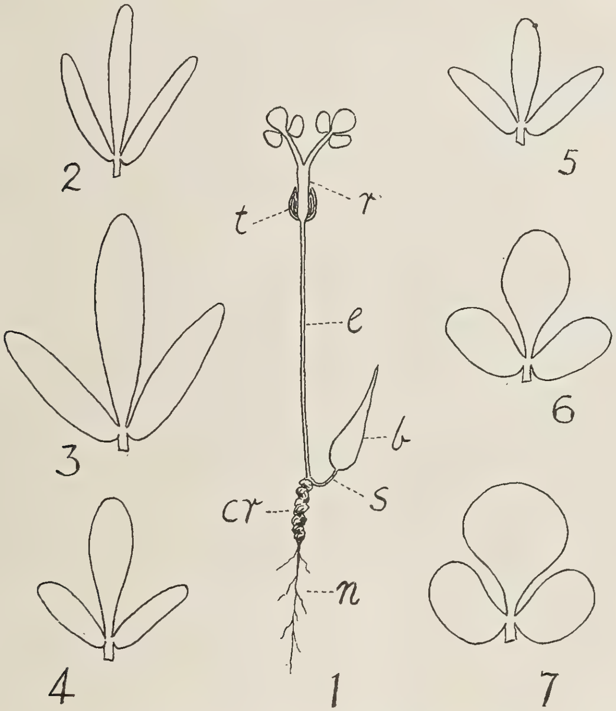

Fig. 1. 1. Diagram of young plant produced from an aerial bulbil of *Oxalis laburnifolia* Jacq., var. *latifolia* Salter, Form B ; (*r*) rhizome ; (*t*) tunics of aerial bulb ; (*e*) intercalary elongation ; (*b*) new bulb on stalk (*s*) ; (*cr*) contractile part of the root ; (*n*) non-contractile part. Outlines of leaves of Forms of *O. laburnifolia* Jacq. (*all half natural size*). 2. *Zeyher* 225 (*wild*). 3. and 4. *Salter* 5445 (*cult.*). 5. Ditto (*wild*). 6. Var. *latifolia*, Form B. 7. Ditto, Form A. (*Del.* T. M. Salter.)

Though it has not been followed through all its stages, the lowering process seems to differ from that of the large slug-like contractile root in such species as e.g. *O. incarnata* L., *O. dentata* Jacq., and *O. purpurea* L. in its younger stages, where the new nutritive bulb scales are almost completely formed within the old bulb before being drawn out and are sessile on the summit of the contractile root.

In the case of the aerial bulbils it is presumed that the origin of the new bulb is a minute bud or bulbil produced in the base of the original bulbil, and, indeed, in one particularly large fresh bulbil, what appeared to be a very minute bud was found on dissection. Even if it began to grow *in situ* there would be no room for it, at its present size, in the aerial bulbil and it probably does not develop until after the contractile action is completed. The intercalary elongation is quite naked as it is in the case of *O. incarnata* and *O. dentata* and there is no trace of any free root-cortex forming a tube for its descent as is the case of the species in § Crassulae, e.g. *O. flava* L.

In " The Genus Oxalis " (p. 31) I referred to the new bulb in species of the § Crassulae* as "being formed laterally on the lower part of the inner core of a specialised root," being then unaware that it actually descends, while still minute, from the base of the original bulb by intercalary elongation of the stem through the loose cortical tube of the root, as noticed by Hildebrand†, nor that there is a further contractile action of the core below it, as since pointed out by Miss A. J. Davey.‡.

ACKNOWLEDGEMENTS.

My thanks are due to Dr. P. Le F. Nortier for obtaining the bulbs, which enabled me to continue my investigation of *Oxalis laburnifolia* and to Dr. M. R. Levyns for her advice in the preparation of Part II of these Notes.

I would also like to take this opportunity of expressing my thanks to Mr. F. W. Thorns, the late Curator at Kirstenbosch, for the particular care that was exercised in preserving the Oxalis bulbs when the new terracing of the Nursery Garden was undertaken and they had to be transplanted, many of them from a great depth : also for the great interest that he took in their welfare in the Gardens.

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* In any future taxonomic revision of the genus and, when the necessary data have been obtained, it would probably be better to include in sub-sections of § Crassulae all the species with this type of underground development, e.g. *O. suavis* R. Knuth, now in § Latifoliolatae and *O. tomentosa* L.f. and *O. palmifrons* Salter in § Multifoliolatae. There are, however, several species in which the action has not been investigated.

† Hildebrand, Lebenverhältnisse der Oxalis-Arten (1884) t. I.

‡ A. J. Davey, On the Seedling of Oxalis hirta L. Annals of Botany X (1946), pp. 250-1.